west the other from the southwest. After coming together, the movement of the whole mass was toward the southeast. The color of the under mass of clouds was of a dirty brown. Darkness came on, and with it gusts of wind. A whirring noise was heard. The trees in the cemetery were observed to go down as the cloudy mass approached. The storm emerged from the cemetery with "a roar" and a funnel-shaped cloud with a twisting movement. After leaving Cypress Hills, the storm followed a varying course along Jamaica avenue to Enfield street, thence parallel with Rockaway road to Woodhaven.

Considerable damage was done to trees and telegraph poles on Jamaica avenue and Enfield street. Ten dwellings on Rockaway road were injured, eight on Second street, and three in University place; in addition to these, the brick schoolhouse was partially destroyed. Union Race Course, which is north of the railroad track, suffered badly, but not so much as the district south of the track. The funnel-shaped cloud, in its passage to the southeast, was observed to rise and fall at intervals; when high above the houses little or no damage was done, but when it came nearer to the earth, buildings in the path sustained the most injury. After leaving Woodhaven, the tornado took a southerly course, decreasing in violence, and passed out over Jamaica Bay, where the waters were observed to be greatly disturbed.

The length of path of storm, where evidences of the tornado are to be seen, is three-fourths of a mile; the width of greatest destruction is 300 yards, while that of partial destruction is 650 yards.

After the storm a personal inspection of a corn field and several tomato patches showed a very nice distribution of the stalks and plants, as follows: On the southwest side of the path of the storm, they were all lying with their tops toward the east and northeast with notable regularity, while on the northeast side the tops were toward the southwest and west. Similar observations were extended to the scattered timbers of buildings; in many places the same order of arrangement was apparent.

At Woodhaven one person was killed. The investigating committee at Woodhaven has placed the amount of damage to buildings at $25,000. These figures do not include the injury done to the schoolhouse, which will amount to $18,000.

The atmospheric conditions observed at New York station during the afternoon of July 13, 1895, and reduced to sea level, are here given:

75th meridian time.	Pressure.	Temperature.	Time.	Wind direction.	Velocity.
	Inches.	°			*Miles.*
1 p.m.	29.64	70	From 1 to 2 p.m.	S.	9
2 p.m.	29.63	73	2 to 3 p.m.	S.	12
3 p.m.	29.60	72	3 to 4 p.m.	S. and SW.	12
4 p.m.	29.60	73	4 to 5 p.m.	N.	13
5 p.m.	29.61	70	5 to 6 p.m.	E.	3
6 p.m.	29.62	71			

A squall struck the New York station shortly after 3 o'clock, with light rain from 3.18 p. m. to 3.23 p. m., and a maximum velocity of 26 miles.

ATMOSPHERIC TEMPERATURES DURING THE MONTH OF JULY.

By W. F. R. PHILLIPS, M. D., U. S. Weather Bureau.

Atmospheric temperature is well recognized as an important element of climate in general and climates in particular.

The fact that two or more places may have the same mean temperature, either annual, monthly, or daily, does not, of necessity, imply identical thermal conditions. An example will illustrate this fact more forcibly than an elaborate theoretical explanation. Thus, Des Moines, Iowa, and Tatoosh Island, Wash., have the same annual mean temperature, namely, 49°. But the mean temperature of the hottest month at Des Moines is 75°, and at Tatoosh Island 56°. The mean temperature of the coldest month is 18° at Des Moines, and 41° at Tatoosh Island. The highest temperature recorded at Des Moines is 104°, at Tatoosh Island 78°, and the lowest temperature 30° below zero at Des Moines and 7° above at Tatoosh Island. The total range is 134° for the former and 85° for the latter.

Thus it is seen that for a correct apprehension of the thermal conditions of different places, even though on the same isotherm, it is necessary to consider the various phases of atmospheric temperature.

These phases will be taken up in the order following:

1. The mean daily temperature, or the average degree of heat experienced in twenty-four hours; which, meteorologically defined, is the arithmetical mean of twenty-four hourly observations; but which, in practice, is found to be sufficiently accurate and more easily obtained by using the mean of the highest and lowest temperatures recorded by self-registering thermometers.

2. The mean maximum temperature, or the average of a series of the highest daily temperatures recorded during a given time.

3. The mean minimum temperature, or the average of a series of the lowest daily temperatures recorded during a given time.

4. The mean daily range of temperature, or the difference between the mean maximum and the mean minimum.

5. The mean daily variability of the temperature, or the average difference between the temperatures of any two consecutive days.

6. The absolute maximum temperature, or greatest degree of heat experienced at any moment during a given time.

7. The absolute minimum temperature, or the lowest degree of heat experienced at any moment during a given time.

8. The absolute range of temperature or the difference between the absolute maximum and minimum.

The first five phases show the temperature probabilities, and the last three the temperature possibilities of a climate. In addition to these statistics of temperature, it is desirable that we should possess information as to the frequency of spells of several consecutive days of either very hot or very cold weather; but to obtain this information it is first essential that we settle upon what shall be regarded as the minimum limit of an excessive departure from average conditions. This is not by any means an easy matter to determine, as an instance will show. At Galveston, Tex., only four times in 15 years has the mean daily temperature in July been 4° above the normal for the month—for that period, 84°. At St. Louis, Mo., in the same years there have occurred 18 days having mean temperatures of 10° or more above the normal, 79°, or more than twice the excess at Galveston. If only the numerical values of the departures from the normals be used as the standard of comparison, Galveston, when compared with St. Louis, would appear never to suffer from periods of abnormally excessive heat; but we find that while in 15 years on sixteen occasions a mean daily temperature of 87° has been maintained for three or more consecutive days at St. Louis, yet, during the same period on twenty-three occasions, a mean of 86.3° has been maintained for three or more days at Galveston. The average duration of these periods has been 6.8 days at Galveston, and 5.6 days at St. Louis.

The question as to the possible physiologic effects of such temperatures, as well as the determination of the limits that shall constitute excessive departures, are features worthy of future study and consideration.

The subject to which this article particularly relates is the distribution of temperature over the United States during the month of July. This month has been chosen, because, first, it is the hottest period of the year, secondly, the high temperatures prevailing during this month are closely associated with the prevalence of a fatal disorder of infantile life—cholera infantum, for which change of climate is recognized as an effective measure of both prevention and cure—and, thirdly, the probability that the great heat of this month is not altogether unconnected with the sudden increase in the prevalence of enteric fever that usually takes place in the succeeding months of August and September.

The temperature records and data herein made use of are those of the Signal Service, War Department, from 1871 to 1891, in which latter year they were transferred to the Weather Bureau, Department of Agriculture, and have been continued to the present time.

With but few exceptions the records are of fifteen or more consecutive years, while some are continuous from 1871 to 1892.

Throughout the month of July the mean daily temperature exceeds 70° in the States bordering on the South Atlantic and Gulf coasts, in the States of the Ohio, lower and middle Mississippi valleys, in the greater part of the Middle Atlantic States, Kansas, and Iowa. In the extreme northern part of the United States the mean daily temperature seldom reaches 70° for more than three or four days. The lowest mean temperature recorded is 56° at Tatoosh Island, in the extreme northwest corner of the country, and the highest mean temperature is 92° at Yuma, Ariz.

The normal mean temperatures for July recorded at the Weather Bureau stations along the northern border of the United States, beginning at Eastport, Me., and going westward, are as follows: Eastport, 60°; Oswego and Rochester, 70°; Buffalo, 69°; Erie and Cleveland, 71°; Sandusky and Toledo, 7°; Detroit, 72°; Port Huron, 68°; Alpena, 66°; Marquette, 65°; Duluth and St. Vincent, 66°; Williston, 69°; Havre, 68°; Spokane Falls, 69°; Port Angeles, 57°; Tatoosh Island, 56°. Along the southern limits, beginning at Key West with 84°, and going westward: Tampa, 82°; Pensacola, 81°; Mobile, 83°; New Orleans, 82°; Galveston and Corpus Christi, 84°; El Paso, 83°; Yuma, 92°; San Diego, 68. On the Atlantic Coast are temperatures ranging from 60° at Eastport to 84° at Key West, or a difference of a little more than one degree of temperature for each degree of latitude. On the Pacific Coast the difference between Tatoosh Island, 56°, and San Diego, 68°, is 12° of temperature for 16° of latitude, or three-fourths of a degree of temperature for each degree of latitude; but the difference is not uniformly distributed, from Tatoosh Island to San Francisco there are but 3° difference, while from San Francisco to San Diego there are 9° difference.

The isotherm of 70° passes through southern New Hampshire, westward through northern New York, across Lake Erie, through lower Michigan, into extreme southern Wisconsin; then northwesterly through Wisconsin, traversing central Minnesota, the contiguous portions of the Dakotas, into Montana, where, bending southward, it passes through Idaho and parts of Oregon into northern California to near the coast, where it turns sharply to run southeasterly till near Los Angeles it leaves the land and emerges on the Pacific.

The isotherm of 80° traverses the southeastern portions of North Carolina, the northern parts of South Carolina and Georgia, northeastern Alabama, central and western Tennessee, northern Arkansas, Indian Territory, extreme northwestern Texas, southern New Mexico, central Arizona, and southern California.

The isotherm of 90° is seen in the southwestern portion of Arizona and in southwestern California. Small portions of the isotherm of 60° are seen in northern Maine and in northwestern Washington.

Between the isotherms of 70° and 80° are included all the States, except Oregon, Washington, and parts of New Hampshire, Vermont, Michigan, Minnesota, North Dakota, Montana, and Idaho to the north of 70°, and Texas, Louisiana, Mississippi, and Florida, and parts of Arkansas, Georgia, and South Carolina to the south of 80°.

The mean maximum temperature varies from 69° at Eastport to 90° at Key West, on the Atlantic Coast; from 61° at Tatoosh Island to 74° at San Diego, on the Pacific Coast; and from 77° at St. Vincent to 98° at El Paso, and 107° at Yuma, in the interior. In the Gulf States the mean maximum ranges from 90° to about 95°, and in the northwestern and western parts of Texas from 93° to 99°. On the Atlantic Coast south of North Carolina the mean maximum is 90°. In the Middle Atlantic States, the Ohio, middle Mississippi and lower Missouri valleys, in Kansas, Nebraska, Colorado, and the central Plateau regions, and in the greater part of California the mean maximum ranges between 85° and 88°. In the States along the northern boundary of the country and in Wyoming the mean maximum varies from 75° to 80°.

The mean minimum temperature varies from 52° at Eastport and Tatoosh Island to 79° at Key West and 62° at San Diego. In the South Atlantic and Gulf States and in the lower part of the middle Mississippi Valley the means are generally about 73°, while in the Middle Atlantic States, the Ohio Valley, lower Lake Region, lower Missouri and upper Mississippi Valleys, in Kansas and Nebraska the mean minimum is about 65°. In nearly all the States of the Rocky Mountain and Plateau regions and of the Pacific Slope the mean minimum is about 55°.

East of the Mississippi River during July the mean daily range, or difference between the mean of the maximum and the minimum, is about 18°, and west of the Mississippi it is from 5° to 10° greater, increasing with the elevation above sea level. On the Pacific Slope the mean daily range is generally from 10° to 15°, but may vary considerably on either side of these limits as it is affected by either altitude or proximity to water, as at Sacramento it is 30°, while at Tatoosh it is only 9°.

The mean variability of temperature, or change from day to day, is less in July and August than in any other months of the year, and is so nearly alike in either that it is not practicable to discriminate between them in this respect; in other words, July and August are the most equable months of the twelve as regards temperature. On the Pacific and Gulf coasts the variability is little more than one degree. As we go northward and inland the variability gradually increases. In the latitude of Savannah it is equal to 2° and in that of Washington, D. C., 3°. The greatest mean daily is observed in Montana and in the Dakotas, where it reaches 4° to 5°.

The absolute maximum temperatures recorded in the different States in July are pretty nearly uniform. One hundred and eight degrees have been observed at Havre, Mont., and 106° at San Antonio, Tex. Some of the most notably high temperatures are: 122° in Death Valley, Cal.; 118° at Yuma, Ariz.; 112° at El Paso, Tex., and Red Bluff, Cal.; 110° at Tucson, Ariz. The place having the lowest maximum is Tatoosh Island, 78°. Temperatures of 102° to 105° have been observed in nearly all the interior States.

The absolute minimum temperatures in July have ranged from 70° at Corpus Christi, Tex., to 31° at Havre, Mont. The minimum temperature appears to be more influenced by latitude than the maximum.

The greatest absolute range (both monthly and daily) of temperature is, as might be inferred, experienced in the Dakotas and Montana, and the least along the Gulf Coast.

East of the Rocky Mountains the highest mean daily temperatures have been observed generally in the central valleys and in the South Atlantic States. The highest mean recorded for any one day is 94° at Augusta, Ga., and the next highest, 93°, at Kansas City and San Antonio. Mean daily temperatures of 91° and 92° have been recorded generally throughout these regions. On the immediate Gulf Coast and in the extreme lower Mississippi Valley the highest means for one day that have been noted have been from 87° to 89°. In New England, the Middle Atlantic States, the region of the Great Lakes, the Rocky Mountain and the Plateau regions the highest mean daily temperatures have been about 85°.

The lowest mean daily temperatures have ranged from 75° on the Gulf to 55° in the northern portions of the United States. In the greater part of the country the lowest mean temperatures range between 60° to 65°.

North of the thirty-fifth parallel of latitude the mean daily temperature is generally from 4° to 6° higher in July than in June, and from 2° to 3° higher than in August. South of this parallel the July means are from 2° to 3° greater than those for June, and 1° to 3° greater than for August.

NOTES BY THE EDITOR.

LETTER TO VOLUNTARY OBSERVERS.

U. S. DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU,
Washington, D. C., July 20, 1895.

To Voluntary Observers, Forecast Displaymen, and Crop Correspondents of the Weather Bureau:

In assuming charge of the Weather Bureau, as its Chief, to which position I was recently appointed by the President of the United States, I desire to express to the voluntary observers, forecast displaymen, and weather crop correspondents through the Directors of the several State Weather Service organizations, my high appreciation of the value of the services, voluntarily rendered by them in their several lines, without which it would be wholly impracticable for the Bureau to carry on some of its most important work.

Having for a number of years been actively engaged in state weather service work, I have, in my official career, been placed in close relations with those serving the Bureau in a voluntary capacity, and the high estimate of the value of their cooperation is based upon a practical knowledge of the valuable results that have been attained.

It is my most earnest desire to make the Bureau of the utmost value to the general public in every way possible, and, with the continued cooperation of those who have contributed so much to that end in the past, it is believed that the future usefulness of the Bureau will be greatly increased.

Very respectfully,

WILLIS L. MOORE,
Chief of Weather Bureau.

REPLIES TO CORRESPONDENTS.

The great interest taken in meteorology is emphatically manifested by the self-denying labors of the voluntary observers throughout our country, who everywhere maintain meteorological records with a persistence and thoroughness that redounds to the benefit of science. The labors of such men during the past two centuries have been the basis on which our present knowledge is founded. Sometimes, however, the efforts of individuals to advance our knowledge take the form of rather wild suggestions. The Chief of the Weather Bureau finds frequent occasion to encourage the well-directed efforts of our most enterprising co-laborers, but those whose suggestions are not indorsed favorably should not be too deeply disappointed. Communications are often received that reveal imperfect knowledge of the laws of meteorology, even on the part of those who are otherwise well informed. This is not to be wondered at when we consider how few have had an opportunity of studying the motions of the atmosphere on a large scale, or of investigating the minuter details of localities, instruments, and records. In order, however, that the members of the service may profit by our wider knowledge of these matters the Chief imposes upon the editor the duty of making some response. He hopes thus to disseminate in this country sound views as to meteorology.

(*a*) *Thermometric scales used in meteorology.*

A recent proposition to change the scale of our thermometers, viz, to put the zero higher up, viz, at the so-called "blood-heat" or internal temperature of the human body, and to count all temperatures as negative below that point and positive above it, meets with unqualified disapproval. The thermometer was originally introduced into science by physicians, who wished to measure the so-called temperament of the patient, but this was nearly three hundred years ago, and the instrument that was used by the physician Sanctorius was crude and was, in fact, abandoned as soon as Galileo and the glass-blowers of Florence made more accurate instruments, almost identical with the mercurial and spirit thermometers of to-day. For nearly two centuries thermometer makers amused themselves with devising new variations on the early methods of graduating and numbering the scale. Any one of these would have answered the need of the meteorologist and all were more or less arbitrary, but the great diversity led to unnecessary confusion and trouble, and the tendency of the last century has been to use either the Centigrade or the Fahrenheit scale to the exclusion of all others. The motto of the scientific world is—uniformity and simplicity in the units and standards by which we measure all dimensions and forces. At present the metric system is the one most used by scientists, but the English system, which is far less simple, still has many adherents. No others are needed. Uniformity or conformity with a single standard is most desirable.

(*b*) *The winds of Japan and Arizona.*

A correspondent seems to have adopted the idea that the northwest winds of Japan and the southeast winds of Arizona may be considered as one system blowing towards each other and mutually affecting each other. A glance at any work on physical geography or meteorology shows that regions separated from each other so far as these, have lying between them other systems of winds, so that the conditions prevailing at these extremes can only affect each other by a very indirect route, if at all. It is true that northerly winds prevail at certain seasons on the coasts of China and Japan and at certain other seasons on the coast of California, but the latter wind is not at all to be considered as a continuation of the former. There can be no doubt but that the conditions and phenomena in the atmosphere over one part of the globe have some sort of an effect on the conditions and phenomena everywhere else, but what this effect may be, or how appreciable it is, is a very difficult question. Before we speculate on the influence of the weather in Japan upon that in Arizona we must make sure that we first understand the mutual influence of the weather in regions that are nearer home.

CLOUD PHOTOGRAPHY.

Referring to the article on cloud photography in the MONTHLY WEATHER REVIEW for May, Mr. A. J. Henry desires to state that in the formula for the developer the quantity of C and P should have been stated at 16 parts of each (by weight) to 100 parts of water (fluid ounces). In addition to the normal developer, there described, the following modifications may be found useful. For under-exposed plates use the normal developer without the bromide. When great contrasts are desired use the following: 75^{cc} H + 10^{cc} each P, C, and B.